Anomalous antennae such as these seem to be very scarce in the Cantharidae, these two examples being the only ones noticed out of thousands of specimens examined. It would be interesting to know of similar findings in other groups of beetles.

I would like to express my appreciation to R. O. Schuster and T. N. Seeno for the loan of the Cantharid sections of the collections under their control, in which these specimens were found, and to my son, William M. Fender, for photographing the specimens.

Biological and Taxonomic Notes on *Brachyogmus ornatus*, with Descriptions of Larval and Pupal Stages (Coleoptera: Curculionidae)[1]

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The weevil genus *Brachyogmus* Linell and its only included species, *Brachyogmus ornatus* Linell, were originally described in 1897 from material collected in California. The few subsequent references to these taxa in the literature consist mostly of their inclusion in catalogues (Leng, 1920; Schenkling and Marshall, 1934) and in a generic key (Kissinger, 1964). Tanner (1966) discussed the species in connection with a study of the weevils of the Nevada Test Site. Observations on the biology of *Brachyogmus ornatus*, descriptions and illustrations of the larval and pupal stages, and a review of the taxonomic relationships of the species are included in the present paper.

Biology

Tanner (1966) published the first host record for *Brachyogmus ornatus*, stating that the species "breeds in the flowers and seeds" of *Lycium pallidum* Miers. in Nevada. Label data indicate that adults of the species have also been collected on additional species of *Lycium* in California and Arizona. My first attempt to collect the species, mainly for the purpose of obtaining the immature stages, occurred during August, 1965 in the vicinity of Estancia, New Mexico. A few adult weevils were beaten from plants of *Lycium pallidum*, but the immature stages were not found at that time. The plants were mostly in a vegetative stage of growth, with a few mummified flowers being present. Some of these flowers had exit holes and larval feeding cavities suggestive of previous weevil infestations.

The same area was revisited on July 11, 1967, at which time the plants were profusely blooming and fruiting. Adults, mature larvae, and pupae of *B. ornatus* were collected in abundance. Mature larvae occurred within closed flowers feeding usually on the bases of the stamens and on the ovary. Some larvae apparently

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[1]Technical Contribution No. 7474. Department of Entomology, Texas Agricultural Experiment Station, Texas A&M University, College Station. This study was partly financed by U. S. Department of Agriculture Contract No. 12-14-100-7733(33).

feed entirely upon the anthers, while others consume all structures of the flowers except the corollas. The petals of each infested flower are tightly and neatly folded together at their apices, thus providing an enclosed chamber in which the larva develops. Infested flowers are easily detected because the closed petals form a clavate corolla tube which contrasts conspicuously with the normal trumpet-shaped one. Only one larva was found in each flower. Although no flower buds were seen on the plants at the time observations were made, the advanced stages of the larvae feeding in the flowers indicates that the eggs are possibly deposited in the buds and larval feeding continues after flowering takes place. Apparently the damage caused by the feeding of the young larvae in the buds is not sufficient to prevent completion of the flowering process. No evidence was found of larvae developing in the seeds as mentioned by Tanner (1966).

Pupation occurs in the larval feeding cavity and the adult weevil emerges through a hole in the side of the corolla tube. The pupal stage of the few specimens observed required approximately 6 days.

The weevil larvae were parasitized by a pteromalid wasp, *Heterolaccus hunteri* (Crawford)[2]. This is a common weevil parasite which is known to attack several species of *Anthonomus,* as well as species of two other anthonomine genera, *Tachypterellus* and *Smicraulax,* and also members of some other curculionid and bruchid genera (Mueseback, *et al.* 1951; Krombein, 1958). Although few specimens of the parasites were reared, evidence that the weevil is heavily parasitized is indicated by the fact that parasite emergence holes in the corollas were numerous and several weevil larvae were found dead in their feeding cavities.

Hosts and Distribution

The observations of Tanner (1966) and those presented here establish *Lycium palidum* as a true host of *Brachyogmus ornatus,* but some other members of this plant genus are undoubtedly also utilized as hosts by the weevil. Adult weevils have been examined which were collected on *Lycium andersoni desertícola* at Desert Springs, Calif., on *Lycium cooperi* near Mojave, Calif., and on *Lycium exertum* near Sells, Ariz. Specimens have also been collected on an undetermined species of *Lycium* in Texas. Hitchcock (1932) states that there are 14 native species of *Lycium* in North America. Most of these occur in the southwestern and western United States, and in northern Mexico.

Additional label data on specimens examined refer to collections on cotton plants and in ground trash bordering a cotton field in the State of Sonora, Mexico. The presence of these weevils on cotton is probably accidental, while their occurrence in ground debris indicates that they may overwinter or survive other unfavorable periods in such places.

The distribution of *B. ornatus* as determined from examined specimens is shown in Figure 9.

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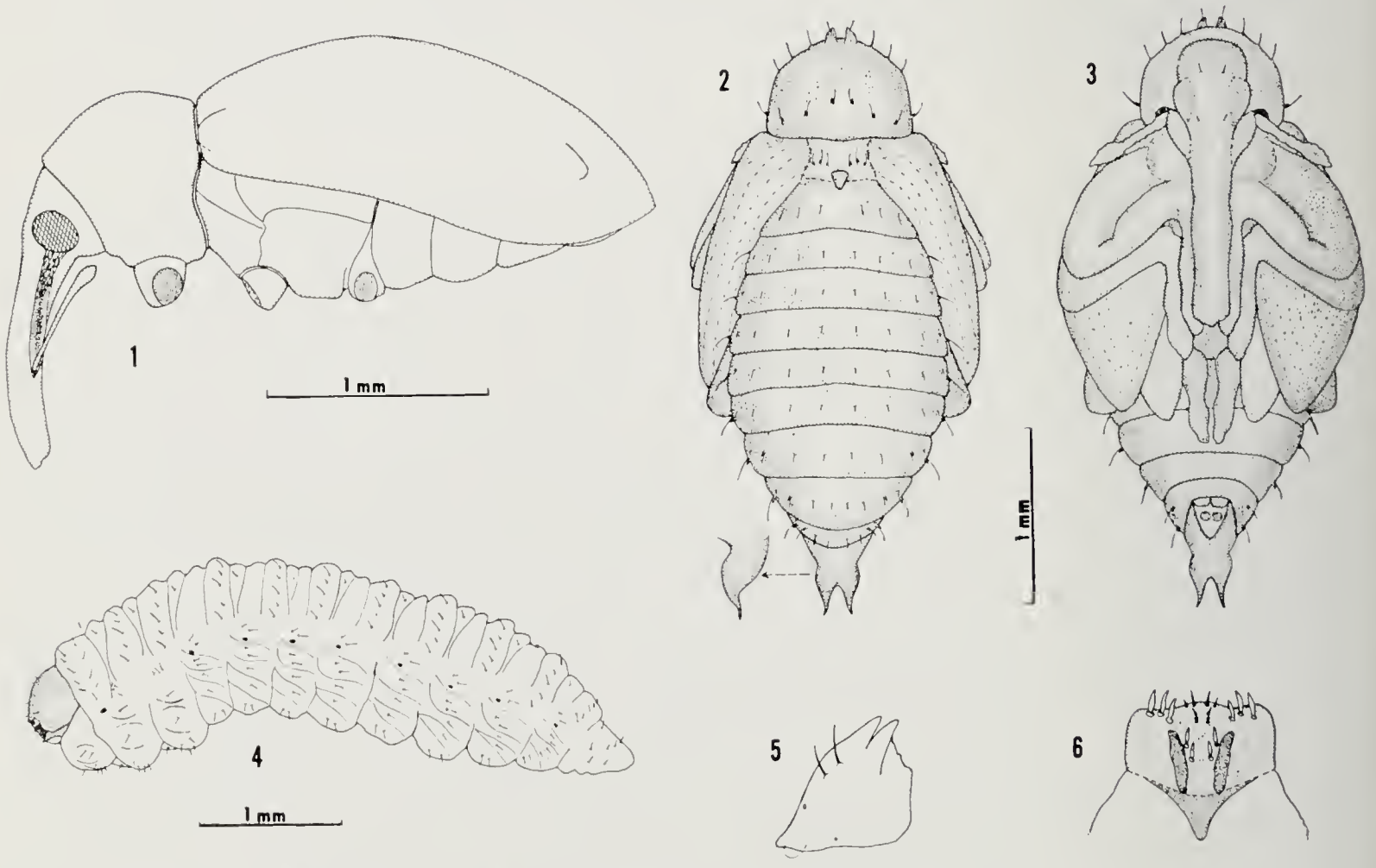
[2]Determined by B. D. Burks, U. S. Department of Agriculture, Washington, D. C.

Descriptions of Larval and Pupal Stages

The terminology of the setae and other structures of the larva follows that proposed by Anderson (1947). Pupal setae are designated by the system published by Burke (1968). The material on which these descriptions are based was taken from flowers of *Lycium pallidum* at Estancia, New Mexico, July 11, 1967, by H. R. Burke. The immature stages were identified by association with reared adults. Specimens are deposited in the collections of Texas A&M University and the U.S. National Museum.

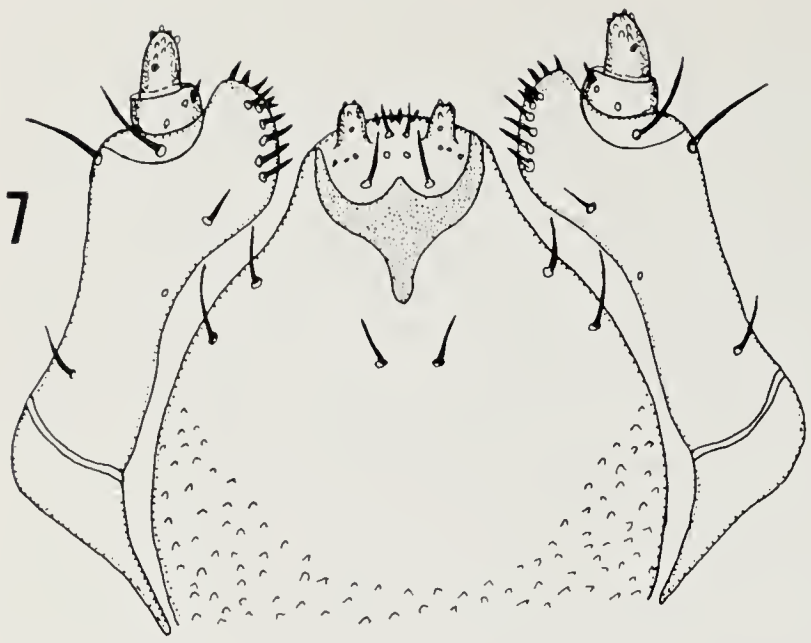
LARVA-BODY-Length, 3.6-4.4 mm. (8 mature larvae). Moderately slender; usually slightly curved (Fig. 4), but sometimes strongly curved; without conspicuous pigmented areas; asperities small, rounded, slightly more dense on thorax and underside of body. HEAD—Free (Fig. 4); mostly light yellowish, sometimes to varying extent suffused with darker color; mandibles dark brown; head capsule distinctly broader than long, width 0.46-0.61 mm. (9 larvae). Frontal sutures wide with irregular margins (Fig. 8); epicranial suture about ½ as long as head capsule; endocarina well defined, approximately ⅗ as long as frons. Setae on head vary from fine to stout; dorsal epicranial setae 1, 2 and 3 about equal in length, setae 4 and 5 slightly longer; frontal setae strongly atten-

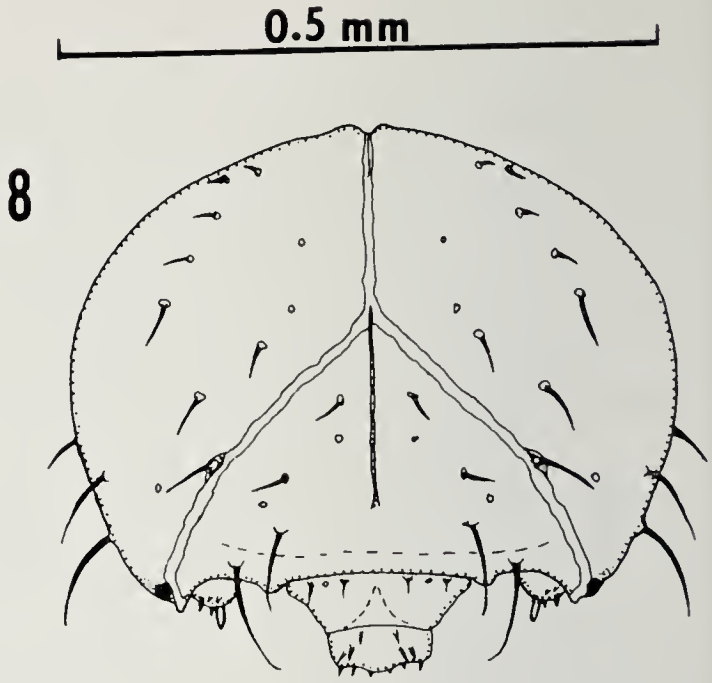


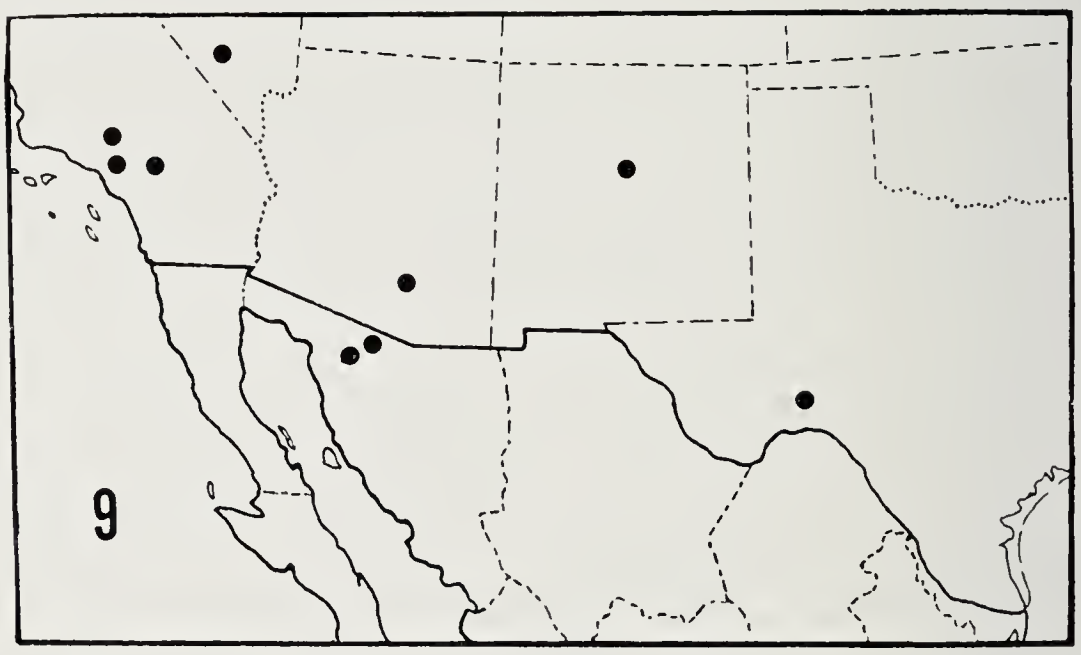
FIGURES 1-6—*Brachyogmus ornatus* Linell. (Figures 1, 2, 3, and 4 each drawn to scale indicated by line; figures 5 and 6 greatly enlarged). FIGURE 1. Lateral view, with scape of antenna in natural position. FIGURE 2. Pupa, dorsal view. FIGURE 3. Pupa, ventral view. FIGURE 4. Larva, lateral view. FIGURE 5. Left mandible of larva. FIGURE 6. Epipharynx of larva.

uate, setae 4 and 5 much longer than others, seta 2 absent; lateral epicranial seta 2 about twice as long as 1. Antenna bearing finger-like elongate, accessory appendage and four short setae, one of which is longer than others. Clypeal setae short, equal in length, each borne on a small, rounded tubercle; sensilla present. Labrum with three pairs of stout, strongly attenuate setae, anterior pair shortest. Epipharynx (Fig. 6) with three pairs of anterolateral setae, three pairs of anteromedian setae, two pairs of median spines; elongate labral rods converging slightly posteriorly; sensory pores arranged in two groups of 2 pores each, located directly behind the posterior-most pair of anteromedian setae. Mandible (Fig. 5) subtriangular, with two elongate teeth at apex; mandibular setae 1 slightly shorter than 2, each borne on small tubercle. Maxilla (Fig. 7) bearing maxillary palpus of two articles, basal article with a short seta near inner margin. Mala of maxilla with six dorsal and five ventral setae. Stipital setae 3 and 4 longest, 2 shortest. Labial palpus consists of a single segment. Premental sclerite with well-defined posterior and lateral projections, anteromedian projection short. Premental setae equal in length to stipital seta 1. Glossa bearing three pairs of setae, posterior-most pair longest. Postmental seta 2 slightly longer than either 1 or 3. THORAX—Pronotum (Fig. 4) bearing 10 moderately long setae on each side. Air tubes of bicameral thoracic spiracle with apparently 6 or 7 annuli. Prodorsum of meso- and metathorax each bearing a moderately long seta on each side of midline. Postdorsum of meso- and metathorax bearing five setae on each side of midline; setae 1, 3 and 5 longer than setae 2 and 4. Meso- and metathorax each with three spiracular setae, two of which are about equal in length, third much shorter. Pleural setae consist of two long ones on prothorax, one of similar length on each of meso- and metathorax. One epipleural seta present on each of meso- and metathorax. Pedal area bearing three long setae and a shorter one on each of the thoracic segments. A fairly long sternal seta present on each side of the midline of each of the three thoracic segments. ABDOMEN—Abdomen (Fig. 4) with eight pairs of bicameral spiracles. Abdominal segments I through VII each with three dorsal folds of which the postdorsum is most prominent. Prodorsum of each segment with one seta on each side of midline; postdorsum of each segment with five setae of which setae 1, 3 and 5 are longer than 2 and 4. Abdominal segments through VIII with two spiracular setae of unequal length on each side; two epipleural setae; one pleural seta; one pedal seta; and two eusternal setae. Abdominal segment IX with several short setae on each side. Anus ventral, subterminal.

PUPA (Figs. 2, 3)—Length—3.1-3.8 mm. (15 pupae). ROSTRUM—Distirostral setae absent. One pair of fine, attenuate basirostral setae separated by distance equal to about twice length of a seta located on rostrum at about level of apices of antennal scape. HEAD—Frontal setae fairly conspicuous, parallel-sided to feebly attenuate, sometimes borne on slight tubercles, separated by distance equal to twice length of a seta. Supraorbital setae lacking. PROTHORAX—Prothoracic depressions well defined. Pronotal setae pale, attenuate, straight to slightly curved. Anteromedian setae each located subapically on anterior face of fairly tall subconical tubercle; tubercles narrowly separated at bases. Three pairs







FIGURES 7-9—*Brachyogmus ornatus* Linell. FIGURE 7. Labium and maxilla of larva, ventral view (greatly enlarged). FIGURE 8. Head of larva, dorsal view, scale indicated. FIGURE 9. Distribution of B. ornatus.

of anterolateral setae of about equal length; series on each side in a straight row; alP_1 usually on summit of low, rounded tubercle, others usually not on tubercles. Posteromedian setae each borne at base on posterior side of a sharply pointed, sclerotized tubercle; tubercles separated by distance either equal to, or slightly to distinctly greater than, width of a tubercle at base. Three pairs of posterolateral setae, each of which is borne at the base of acutely-pointed tubercle; tubercles about equal-sized, series on each side arranged in a slightly curved row. MESONOTUM—Three pairs of straight to slightly curved, attenuate mesonotal setae, msN_1 and msN_2 always located at bases of sharply pointed tubercles, msN_3 either borne at base of similar tubercle or on summit of small, rounded one; msN_2 tubercle usually tallest of the three. METANOTUM—Three pairs of metanotal setae; mtN_2 always located at base of small, pointed tubercle, mtN_1 and mtN_2 usually either not associated with tubercles or are borne at bases of minute ones. ABDOMEN—Three pairs of attenuate, slightly curved discotergal on each of first eight terga; dsT_3 on terga 7 and 8, and sometimes on tergum 6, each borne at base of acutely-pointed tubercle; other discotergal setae not associated with

tubercles. Laterotergal setae 1 not associated with tubercles on first four terga, and are located at bases of minute sharply pointed tubercles on following four. Laterotergal setae 2 each about one-half length of tergum on which it is borne; borne at or near base of sharply pointed tubercles which become gradually larger posteriorly. Spiracles small, apparently functional on first five abdominal segments, poorly developed on sixth, absent on seventh and eighth. Abdominal sternal setae lacking. Segment 9 bears a pair of posterolateral processes which are moderately separated at the bases and divergent toward apices; each process curves upward and slightly outward near apex. Segment 9 not bearing setae.

Taxonomic Relationships

Linell (1897) stated that *Brachyogmus* is near the genus *Epimechus*, from which it differs by the "abbreviated scrobes and narrow thorax." The "scrobes" of Linell and most others who have written on the Anthonomini are not true scrobes because the scapes of the antennae do not normally fit into these grooves (Fig. 1); in fact, true scrobes are either absent or poorly defined in the tribe. The grooves which have previously been called "scrobes" in the tribe are here designated as "lateral grooves." The abbreviated appearance of these lateral grooves of *B. ornatus* is caused by scales which fill the shallow basal portion of each groove. This is not an uncommon characteristic in some other anthonomine genera, although the scales in these genera are usually not as closely placed as in *Brachyogmus*. In any event, these characters are of no value for the separation of *Brachyogmus* from other genera of the tribe.

The densely squamose body of *Brachyogmus ornatus* suggests a relationship of this weevil to species of the genus *Epimechus*, as well as to the squamose species of *Anthonomus*. The male genitalia are similar to those of *Anthonomus squamosus* LeConte and its allies, while the simple tarsal claws are shared in common with *Epimechus*; however, *Brachyogmus* is apparently not congeneric with either of these groups. The simple tarsal claws will easily separate adults of *B. ornatus* from all species of *Anthonomus*. One difficulty encountered in separation of *Brachyogmus* from *Epimechus* is that as presently understood the latter contains elements which are clearly not congeneric. Species now placed in *Epimechus* will ultimately have to be distributed within at least two genera. Regardless of this situation, *B. ornatus* is apparently not congeneric with any species now placed in *Epimechus*. The character represented by the elytra sloping gently and evenly from the middle to the apex (viewed from the side as in Fig. 1) is probably the most useful single character for separating *B. ornatus* from *Epimechus*. In fact, this character will distinguish *Brachyogmus* from all other anthonomine genera; the latter have a distinctly defined, and usually strongly sloping, declivity.

The most distinctive adult characters of *Brachyogmus* are: Body densely squamose; elytra in side view gradually sloping from middle to apex; prothorax distinctly narrower than elytra; antennal funicle 6-segmented; tarsal claws simple, widely separated; male median lobe sclerotized dorsally, internal sac with sclerotized structures.

Pupae of *B. ornatus* have no unique character which will distinguish them from pupae of most other genera of the tribe. They trace to the vicinity of *Anthonomus pomorum* Linnaeus, *A. pyri* Kollar and *A. nebulosus* LeConte in my key (Burke, 1968), but judging from adult characters, *B. ornatus* is not at all closely related to these. Pupae of *B. ornatus* possess the pronotal depressions characteristic of the squamose species of the tribe Anthonomini. They differ, however, from the pupae of most known squamose species by having three rather than four pairs of posterolateral pronotal setae. Only three known squamose species, *Anthonomus vestitus* Boheman, *A. squamans* Champion, and *A. testaceosquamosus* Linell ?, have three pairs of posterolateral pronotal setae, and *B. ornatus* is easily distinguished from these by the more widely spaced posterior processes of the ninth abdominal segment.

Larvae of *B. ornatus* differ from those of *Epimechus arenicolor* Fall, (the only species of *Epimechus* for which the larval stage is known), and from larvae of the squamose members of the subgenus *Cnemocyllus* of *Anthonomus* by having one mesothoracic epipleural seta rather than two such setae. *B. ornatus* larvae have only one pleural seta on each of the mesothorax and metathorax, while most of the squamose species of *Anthonomus* (except those of the subgenus *Cnemocyllus*) have two or three pleural setae on each of these thoracic segments.

Analysis of characters of the three developmental stages of *Brachyogmus* appears to indicate that it is most closely related to *Epimechus* and to the species-groups of *Anthonomus* containing squamose species. *Brachyogmus* is, however, distinct enough from these to deserve continued recognition as a genus.

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